

# X-RAYS AND THE REPRODUCTIVE CYCLE IN RING-NECKED PHEASANTS<sup>1</sup>

LEONARD B. CLARK AND GARDINER BUMP

*Union College, Schenectady, New York, and New York State  
Department of Conservation*

While engaged in a study of the effect of visible radiation on the reproductive cycle in pheasants, we found an opportunity to study the effect on the reproductive cycle of x-raying the heads of pheasants.

Normal breeding in pheasants covers the period from the middle of April to about the middle of July in the latitude of Schenectady, New York. After the last eggs are laid, the gonads atrophy and enter a resting period until the next spring when the cycle is repeated. The birds have a single definite reproductive period, are hardy and fairly easily handled, and therefore make desirable experimental material.

In an attempt to secure stimulation of the pituitary gland with acceleration of the reproductive period, the heads of four female pheasants were radiated with 50 and 75 r. of x-rays and of two females with 225 and 425 r. An equal number of males were similarly radiated. The x-ray tube was operated at 200 K.V., the rays being passed through 0.5 mm. copper filter.<sup>2</sup> All other parts of the body were protected by lead-impregnated fabric. The groups receiving 50 and 75 r. were given the total radiation on December 12, 1938, while those receiving the larger doses were given 25 r. on the same date and the remainder on February 1, 1939. Two pairs of pheasants without radiation served as controls. All birds were the same age, of the same strain, and had been raised in the same flock. Each pair of birds was held in a separate pen at the New York State Research Center, Delmar, New York, until two weeks after laying ceased. All were fed the normal breeding ration as used on the State Game Farms.

TABLE I

Dose in roentgens	Egg laying began	Egg laying ceased	Days of laying period	Average eggs per hen	Average eggs per hen per day during laying period
0	Apr. 13	July 2	50	35.5	0.71
50	Apr. 15	May 24	39	13	0.333
75	Apr. 17	May 21	34	11	0.324
225	Apr. 21	May 15	24	8	0.333
425	Apr. 23	May 8	15	6	0.40

<sup>1</sup> Supported in part by a grant-in-aid from the Society of Sigma Xi.

<sup>2</sup> The radiation was made possible through the cooperation of Dr. Albert Lenz, Schenectady, New York.

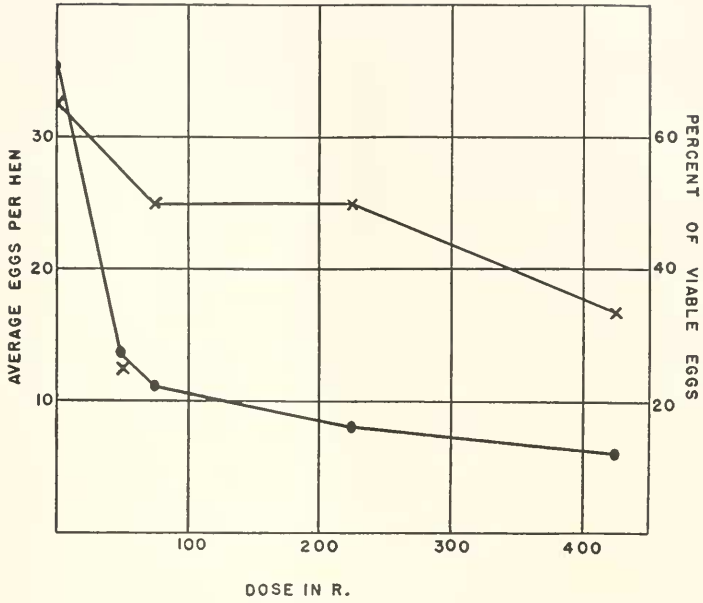


FIGURE 1. Relation between average eggs per hen and percentage of variable eggs and dose of x-rays. Solid circles, average eggs per hen; crosses, percentage of viable eggs.

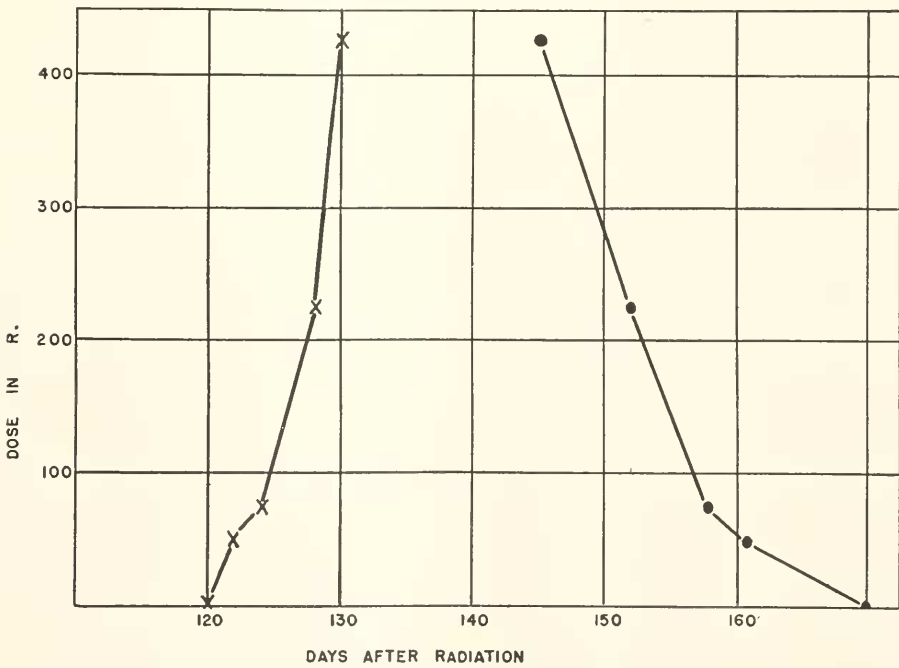


FIGURE 2. Relation between onset and cessation of egg laying and dose of x-rays.

During the 181 days of the experiment no superficial effects of the radiation appeared. Epidermatitis, loss of feathers or other signs indicating localized effects were absent. The weight of the birds fluctuated, but no more than to be expected in any normal group during the breeding season.

The summary of the effects of radiation on reproduction is given in Table I and Figures 1, 2, and 3.

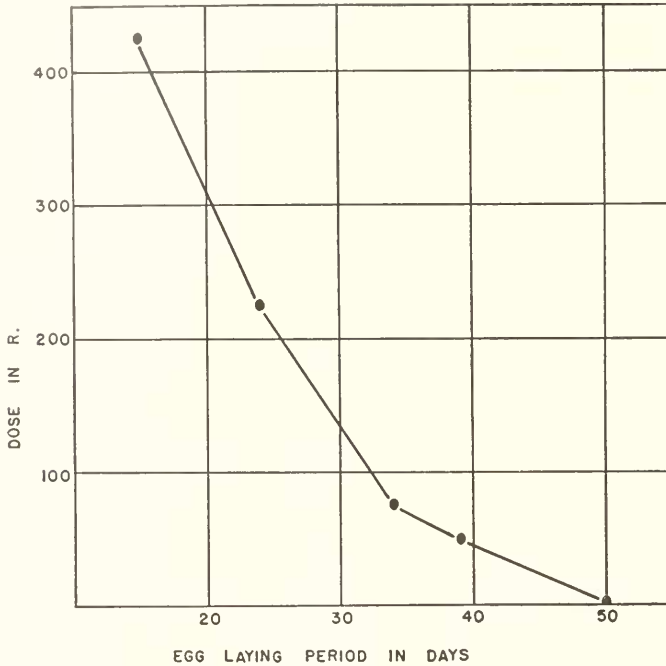


FIGURE 3. Relation between egg laying period and dose of x-rays.

It will be noted (Fig. 1) that the average number of eggs laid per hen varies with the dosage from a high of 35.5 eggs for the controls to 6 eggs for those receiving 425 r.

It will be noted also, Table I and Figure 2, that the time from the beginning of the experiment to the laying of the first egg increases and that the time to cessation of egg laying decreases with the dosage. Thus the laying period varies (Fig 3) from 50 days for the controls to 15 days for birds receiving the maximum radiation. Therefore, the reduced yield of experimental birds must be in part due to their shortened laying period. That this is not the only factor involved is shown in comparing the yield and duration of egg laying of the controls and the birds given 50 r. units of radiation. The ratio of the egg laying periods is 50:39 or approximately 1.3:1 while the ratio of eggs is 35.5:13 or approximately 2.7:1. In other words, the controls laid more than twice as many eggs as would be expected if length of laying period were the only factor involved. The rates of egg laying during the active period were calculated and are given in column 6, Table I. It

will be seen that rate of laying is essentially the same for all experimental groups, but is less than half that for the control birds.

Although heads only were radiated and the first eggs were laid at least two months later, the viability of the eggs seemed to be affected. A measure of viability was taken as the percentage of eggs pipped or hatched on incubation. It will be seen (Fig. 1, B) that viability decreased from 65 per cent in the controls to 33 per cent in the group receiving 425 r. An exception is found in the group receiving 50 r. where only 15 per cent of eggs were viable, but this low value was due to one hen, all of whose eggs but two were either infertile or had dead germs. Consequently, although the data for that dosage are given it is not considered reliable.

The simplest assumption is that x-rays in the amounts given decreased the amount of pituitary hormone by damaging the cells or causing a prolonged partial inhibition of function. The decrease in egg production, rate of laying, and length of laying period would be manifestations resulting from pituitary disturbance.

#### SUMMARY

Pheasants given 50, 75, 225 and 425 r. of x-rays applied to the head region show disturbances in their reproductive cycle by decreased egg production, decreased length of laying period, and possibly decreased viability of eggs laid, the amount of decrease being related to the amount of radiation. The rate of egg laying is decreased in the experimental animals but is not correlated with the dose of x-rays over the range studied.